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ABSTRACT

In addition to the goal of totally acquainting faculty members with the concept of performance-based education, the 1-year project at Northern Montana College had four major objectives: (1) Identify colleges, universities, technical institutes, and area vocational schools throughout the Nation which are currently conducting performance-based programs in vocational-technical teacher education and 2-year vocational-technical programs, (2) identify performance goals and delivery systems for each department within the vocational-technical division, (3) translate existing courses into performance-based criteria and implement them into the teaching schedule for field testing, (4) and begin implementation of a feedback system which is essential to the process of evaluating and refining the performance goals and delivery systems adopted. Faculty were scheduled for meetings with the project staff to establish specific timelines for the development of existing courses and/or programs. Courses were identified for translation to a performance/competency approach via identification of performance goals, and in a number of cases modules were developed with explicit delineation of behavioral objectives and alternative learning activities. To obtain feedback concerning areas to be developed the staff conducted a survey of 507 graduates representing all program areas offered in the division. Responses enabled the staff to focus on specific courses to be adapted to the new mode; responses also guided development of delivery systems. For courses implementing performance based education during the project year, the staff designed and administered opinionnaires to obtain evaluative data regarding the courses. Conclusions and recommendations are included in the report. Copies of the graduate questionnaire and student opinionnaire are appended along with opinionnaire results for three courses: Auto Engines, Shop Maintenance, and the Nursing Program. (JT)

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FINAL REPORT

Project No: 498AH50382

Grant No: OEG-0-74-7514

A Performance-Based Education Program in Vocational-Technical Teacher Education and 2-year Vocational-Technical Associate Degree Programs

Research Project in Vocational Education
Conducted Under
Part C of Public Law 90-576

The project report herein was performed pursuant to a grant from the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors or grantees undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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TABLE OF CONTENTS

LIST OF TABLES i

I. REPORT SUMMARY 1

II. BODY OF REPORT 4

Problem Area Addressed 4
Objectives of the Project 5
General Procedures 6
Results and Accomplishments 9
Part I 9
Part II 63
Conclusions 71
Implications 72
Recommendations 73

III. APPENDICES

Appendix A - Questionnaire for Survey of Vocational-Technical Division Graduates 75
Appendix B - Follow-Up Letter of Transmittal for Survey of Vocational-Technical Division Graduates 79
Appendix C - Student Opinionnaire for PBE Courses 80
Appendix D - Summary of Responses for Items on the Student Opinionnaire for AT 121 Auto Engines 82
Appendix E - Summary of Responses for Items on the Student Opinionnaire for Shop Maintenance 85
Appendix F - Summary of Responses for Items on the Student Opinionnaire for the Nursing Program 88

LIST OF TABLES

Table		Page
I.	Vocational-Technical Division Faculty by Departments	6
II.	Summary of Means by Item for AT 121 Student Opinionnaire	64
III.	Summary of Means by Item for Shop Maintenance Opinionnaire	65
IV.	Summary of Means by Item for LEGS Opinionnaire	66
V.	Sample Selected for Graduate Survey by Program Area	67
VI.	Vocational-Technical Division Graduate Survey Responses by Program Area	68
VII.	Summary of Response to the Question, "Do you think the program would be more desirable if it were to indicate to the student within the first week of the course precisely what is expected for exit or completion?"	69
VIII.	Summary of Response to the Question, "Do you think the program would be more desirable if it were individualized to provide for each student to progress through the course at his own pace?"	69
IX.	Summary of Response to the Question, "Do you think the program would be more desirable if it were to make provision for a student to graduate whenever he/she demonstrates satisfactory performance according to pre-established standards?"	70
X.	Summary of Response to the Question, "Do you think the program would be more desirable if it were to incorporate more alternative methods of instruction, such as, field trips, films, slide-tape material, programmed books, brief on-the-job learning experiences?"	70

REPORT SUMMARY

Project Time Period

This final report of the Performance-Based Education Project at Northern Montana College covers the period of funding from July 1, 1974 to June 30, 1975.

Project Goals and Objectives

In addition to the goal of totally acquainting faculty members with the concept of performance-based education, the project outlined four major objectives for the period of funding:

1. Identify colleges, universities, technical institutes and area vocational schools throughout the nation which are currently conducting performance-based programs in vocational-technical teacher education and two year vocational-technical programs.

2. Identify performance goals and delivery systems for each department within the vocational-technical division.

3. Each department will convert to performance-based education by translating existing courses into performance-based criteria. As courses are converted they will be implemented into the teaching schedule and field tested.

4. Begin implementation of a feed-back system which is essential to the process of evaluating and refining the performance goals and delivery systems adapted.

Procedures

In order to accomplish the objectives of the project, a detailed approach was outlined for the project year. All faculty in the Vocational-Technical Division were scheduled for meetings with the project staff for the purpose of establishing specific timelines for the development of existing courses and/or programs. In various program areas, courses were identified for translation to a performance/competency approach via the identification

of performance goals. In a number of cases, modules were developed with explicit delineation of behavioral objectives and alternative learning activities.

In order to obtain feed-back concerning areas to be developed, the project staff conducted a survey of 507 graduates representing all program areas offered in the Vocational-Technical Division. Responses to the survey enabled the project staff to focus on specific courses to be adapted to a performance-based mode. Responses also guided development of delivery systems, i.e., graduates did not strongly favor total individualization of instruction; but rather, partial individualization or modularization.

For those courses implementing performance/competency based education during the project year, the project staff designed and administered opinionnaires to obtain evaluative data regarding the courses translated to performance-based education.

Articulation of the projects goals and activities to the broader educational community was accomplished by a major presentation to the American Vocational Association (AVA) annual meeting held in New Orleans, December, 1974. A description of the project and its activities was presented to a number of meetings of the Montana Education Association and the Montana Association for Supervision and Curriculum Development (MASCD) held around the state. State education agency officials were continually apprised of the project's activities via mail, telephone and informal meetings.

Results and Accomplishments

The development of performance goals for various areas in the Vocational-Technical Division was the major accomplishment of this project. In numerous cases, the complete development of modules or detailed specification of instructional activity was achieved.

Another major result of this project was the compilation and utilization of information obtained on a survey of 507 graduates representing all program areas in the Vocational-Technical Division. The results of this survey were useful for faculty in the development of programs and/or courses to performance/competency-based instruction. Results obtained from student opinionnaires were of value for modification of courses adapted to performance-based criteria.

Conclusions and Recommendations

Major conclusions reached as a result of the project were:

1. Faculty have a grasp of the performance-based education concept.

2. Faculty will continue to develop curriculum to performance-based criteria after the project has terminated.

3. There was less productivity in the earlier phases of the project than the latter phases.

4. Student satisfaction with performance-based courses is stronger after the course has beed offered for a number of quarters.

5. Translation of programs to performance-based education requires strong administrative commitment and encouragement.

6. Public information activity is necessary for total understanding of the performance-based approach.

The performance-based education project staff, with input from faculty, had the following recommendations as a result of the project:

1. Assignment of at least one individual to maintain contact with faculty regarding information on the status of performance-based education on the national, state, and local level.

2. Studies should be initiated to establish the efficacy of performance-based education as compared to conventional approaches.

3. The college should develop, administratively, mechanisms which allow for implementation of performance-based education, i.e., systems for monitoring individualization, open-entry/exit, competency referenced grading or assessment systems.

4. Instruction should be provided in order to generalize the tenents of performance-based education to the public school community, eg., high schools and elementary schools.

BODY OF REPORT

Problem Area Addressed

In view of the increased attention to competency-based programs and the concomitant demand for "clearly defined outcomes," the Vocational-Technical Division at Northern Montana College addressed itself to the specification of competencies and performances necessary for Vocational-Technical Teacher Training and the training of technicians. (Dickson, Anderson, and DeVault, 1973)

Much of the literature on the topic of "competency-based" education is limited to discussion of the preparation of secondary or elementary school teachers. The project at Northern Montana College was designed to expand on the precepts of "performance-based" education and include the identification of competencies for technicians as well as vocational teacher educators. The major tenents of competency/performance-based education which were adhered to for formulation of the project objectives were:

1. Performance/competency-based programs place an emphasis on exit requirements or achievement of job skills rather than entrance requirements. (Elam, 1972)

2. In a performance-based program, expected student achievement is held constant and time in training varies. (Arends, 1972)

3. The program specifies the criteria levels at which competencies are achieved and the student moves through the program at a rate commensurate with his ability. (Houston and Howsam, 1972; Masla, 1972; Elam, 1972)

In addition to these major tenents, numerous features of competency-based systems are incorporated into the formulation of objectives for this project.

The prime purpose of this project was to identify and validate competencies and delivery systems for the improvement of vocational-technical teacher training programs and the training of technicians. In order to achieve the purpose, a major thrust was made toward identification of basic skills for occupational clusters.

Objectives of the Project

The specific objectives of this project were:

Objective 1: Identify colleges, universities, technical institutes and area vocational schools throughout the nation which are currently conducting performance-based programs in vocational-technical teacher education and two year vocational-technical programs.

Objective 2: Identify performance goals and delivery systems for each department within the Vocational-Technical Division.

Objective 3: Each department will convert to performance-based education by translating existing courses into performance-based criteria. As courses are converted they will be implemented into the teaching schedule and field tested.

Objective 4: Begin implementation of a feedback system which is essential to the process of evaluating and refining the performance goals and delivery systems adapted.

METHODOLOGY

General Project Procedures

In order to accomplish each objective, the Performance-Based Education Project staff assisted faculty members in each of the departments of the Vocational-Technical Division at Northern Montana College with the technical aspects of developing performance goals and objectives.

The instructional staff consists of approximately 31 faculty in 8 departments. Table I depicts the faculty by departments in the Vocational-Technical Division.

TABLE I

VOCATIONAL-TECHNICAL DIVISION
FACULTY BY DEPARTMENTS

Department	No. of Faculty
Agricultural Technology	2
Automotive Technology	6
Cosmetology	2
Drafting	3
Electronics	3
Industrial Arts	4
Nursing	8
Vocational-Technical Teacher Education	3

In order to obtain guidance from practioners in the field, a questionnaire was designed to elicit responses from Northern Montana College graduates representing all program areas in the Vocational-Technical Division. Using commencement lists, a sample of 507 was identified for inclusion in the study. Results of this survey are discussed in the succeeding section on results and accomplishments of the project. (See Appendix A for an example of the instrument)

In an effort to supplement information obtained from graduates of various programs, the performance-based education project staff met with each department in the Vocational-Technical Division. During these meetings, the philosophy

and characteristics of performance-based education were presented to all faculty members. Also, the project staff presented to the faculty various approaches which have been used by other institutions in developing a competency or performance-based program.

Specific meetings with various faculty members provided an opportunity for the project staff to share materials gathered through a literature search and direct contact with other institutions.

In most cases, faculty members agreed with the "course translation approach" as a method for converting to a competency-performance-based mode. The course translation approach is summarized in Robert Houston's Strategies and Resources for Developing a Competency-Based Teacher Education Program. Excerpts of the "course translation approach" most applicable to Northern Montana College follow:

> . . . the staff simply reformulates current courses. The current requirements are rewritten as behavioral objectives for each course, with perhaps institution of some changes in the mode of instruction. In some colleges, one course is piloted before others are translated to competency-based instruction. After initial trial in which students are limited by terms or semesters, time constraints may or may not be lifted.[1]

The project utilized the course translation approach to develop within program areas, i.e., automotive technology, etc., broad performance goals or competency statements.

In certain program areas where goals were developed early, specific objectives were detailed and modularization of the course was possible.

Although, in most instances, performance goals were delineated course by course, there were exceptions to this

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[1]Houston, Robert W., Strategies and Resources for Developing A Competency-Based Teacher Education Program. (New York: State Department of Education, 1972), pp. 31-33.

approach. For example, the performance goals for cosmetology were developed as a total set for the entire program, since the individual course work in cosmetology is strongly interrelated. A natural grouping by areas of performance was apparent and performance goals for these areas were established.

For those courses which implemented some type of performance-based program during the 1974-1975 academic year, the project staff designed opinionnaires to gather student response to the approach used.

The activities of the project were communicated to various groups through meetings, news announcements, and printed material. The following is a summary of information related activities which took place during the project year:

1. The project disseminated, on a regular basis, the Performance-Based Teacher Education Newsletter, published by the PBTE Consortium to all faculty.

2. The project director presented a report of Northern Montana College's Performance-Based Education Project to the annual meeting of the American Vocational Association held in New Orleans, December, 1974.

3. The project director attended a meeting sponsored by the Bureau of Occupational and Adult Education, Division of Research and Demonstration, to discuss the progress of the project.

4. The project assistant director attended meetings of the Montana Education Association and the Montana Association for Supervision and Curriculum Development to articulate the project's activities.

5. The project director and assistant director attended a leadership training institute on performance-based teacher education sponsored by the American Association of Colleges for Teacher Education.

RESULTS AND ACCOMPLISHMENTS

This section is divided into two parts. Part I provides information on those results which coincide with the goals and objectives of the project including products obtained through accomplishment of the project objectives. Part II provides results obtained through the survey of graduates and compilation of information obtained from student opinionnaires.

Part I

The results presented in this section correspond directly to the project objectives listed in the section Objectives of the Project.

Objective 1:

> Identify colleges, universities, technical institutes and area vocational schools throughout the nation which are currently conducting performance-based programs in vocational-technical teacher education and two year vocational-technical programs.

To accomplish this objective, the Performance-Based Project surveyed all institutions listed in the directory of the National Council for the Accreditation of Teacher Education (NCATE).

Responses were catalogued by state and in some cases by type of project or competency-based program utilized. For those postsecondary schools with an emphasis in vocational education, contact was established to determine specific materials which would be applicable to program offerings at Northern Montana College. Also, publications from the Office of the Superintendent of Public Instruction, Montana were examined for materials related to the program offerings within the Vocational-Technical Division. One major result in this area was the stimulation of various faculty members to revise present structure and to expand the knowledge base relative to different program content within particular areas such as drafting, auto-mechanics, etc.

Objective 2:

Identify performance goals and delivery systems for each department within the Vocational-Technical Division.

The identification of performance goals and delivery systems for each department was accomplished in a variety of ways. In some instances, departmental faculty met to discuss existing course offerings and program goals. As a result, some departments arrived at statements of performance and requested assistance from the project staff to develop a set of performance goals for existing course offerings.

In other cases, either the examples provided by the project staff or through direct meetings with the project staff, statements of performance were developed to correspond to existing course offerings.

In addition to the performance goals, a number of courses were modularized. Each module developed contained performance goals and specific behavioral objectives required for competency attainment. Multiple learning activities were provided within each module.

In addition to the performance goals which follow, the Automotive Technology Program had three courses converted in-depth to a performance-based mode. Auto Engines I, Small Engines, and Automotive Suspension and Alignment were translated into a competency-based format with detailed specification of jobs and operations. Further individualization in this area was provided by the procurement of individual engines to accompany the occupational sequence performances specified.

The following performance goals were identified with each department in the Vocational-Technical Division. For this reporting, the departments have been listed as they were administered on campus, i.e., Agricultural Technology (including Agri-Business, Farm and Ranch Management, Ag. Mechanics, and Agri-Services), Automotive Technology (including Auto Body Service, Auto Service, and the Bachelor of Science Degree), Cosmetology, Drafting (including the Associate Degree, Bachelor of Science Degree, and One-Year Certificate), Engineering/Electrical Technology (including Electronics Technology-Communications Option, the Bachelor of Science Degree, Construction Engineering Technology-Civil Option and Building Option, Electronics Engineering Technology, Mechanical Engineering Technology-Industrial Option and Mechanical Option, Electronics Technology -

Associate Degree, Electrical Technology, and Electronics Technology-TV Option), Industrial Arts (including broad-field majors in Automotive, Drafting, Electronics, and Metals), Nursing (including Practical Nursing and Associate Degree Nursing), and Vocational-Technical Teacher Education (including the professional course in teacher education related to auto-mechanics, drafting, electronics, trade and technical, and the graduate program).

The performance goals for courses identified as general education have not been included in the listing. Such courses may be selected from a wide range of electives and therefore will result in different competencies for individuals in the program. The performance goals for the Nursing program were not developed locally since a commercial product was purchased. More information on this program is provided in Part II of this section.

AGRICULTURAL TECHNOLOGY

Key to abbreviations:

B Agri-Business Option
F Farm and Ranch Management Option
M AG Mechanics Option
S Agri-Services Option

Programs required for	Course No.	Performance Goal
		The student will:
B S F	104.	recognize the types and breeds of beef cattle on American farms and know the approved practices of beef production.
F M	105.	be able to apply the fundamentals of carpentry to the construction of farm structures and to participate in discussions of the design and erection of buildings, concrete work, house framing, and building design.
B F S	114.	know the principles of animal nutrition and practical feeding of livestock and develop an understanding of the composition, properties, and used of all feeds.
F S	115.	know the modern methods of farm flock and range sheep production based on historical development, types, breeds, breeding, selection, management, and marketing practices for wool and lambs.
F S	124.	know the historical development, types, breeds, breeding, selection, management, and marketing practices for modern pork production.
B F M	125.	know the agricultural development and advancement of farm and ranch management; understand the managerial balance of land, labor, and capital and the practices used to get the greatest return; know farm and farmstead layout, arrangement and planning, farm safety, diversification of enterprise and governmental practices.

Agricultural Technology cont.

B	126.	develop skill in the use of maps and map substitutes through knowledge of marginal information, location distance, relief, and practice in the use of a level and transit.
Elective	134.	have a basic understanding of the grain, feed, seed, and farm supply industry and know the areas of agricultural production and services involved in each phase of the food cycle including those rendered the farmer.
B F S M	204.	know the nature and properties of soil, be able to classify it and understand the use of management of soils.
F	205.	know the methods of raising vegatables and small fruits, the use and management of shelter belts, lawns, shrubs. Know the necessary criteria for home landscaping and beautification as adapted to the plains area.
M S	206.	know the principles of economics and agricultural marketing functions, agencies, services, and problems with emphasis on Montana crops.
S	207.	know the properties, uses, rates and methods of application with emphasis on servicing and merchandising of agricultural chemicals.
S	217.	make studies in the movement of grain from the farm through the country elevator, grain storage and merchandising to the consumer.
B F M S	218.	have an understanding of the art and science of crop production with emphasis on growth, development and management of various crops and be able to identify and grade grains.
B F M	220.	make a study of common and noxious weeds in Montana, including identification and control measures.
S	224.	have an understanding of the physiological functions, sources and recommended levels of nutrients in livestock rations with special emphasis on commercial feed formulation and registration.

Agricultural Technology continued

S	225.	be able to apply merchandising principles to farm supplies commonly distributed through farm supply centers.
B F	234.	know the ecology and physiology of plants in relation to grazing topography and climate. be able to identify the important range grasses and forages. know the principles and methods of range utilization.
F M	235.	know the maintenance, servicing, alignment, adjustment and general repair of common farm machines and equipment.
S	236.	justify methods and procedures for: A - obtaining a representative sample of grain for grading purposes, B - identifying and labeling field seeds, C - determining field seed purity, D - grading grain. understand facts and principles of grain grading according to the Official Grain Standards of the United States. know specific facts relative to: A - identification of classes and subclasses of grain, B - identification of field seed purity, C - protein determination, D - grain grading.
S	237.	be able to apply the principles of business management to agri-business enterprises.
S	238.	understand the principles of sales and servicing of commercial fertilizers and interpret soil testing, make fertilizer recommendations and describe bulk fertilizer formulation and its applications.
Elective	254.	know feed manufacturing methods, machinery, ingredients, and Federal and State regulations and be able to clean, test, grade, treat and label grains commonly produced and used in Montana in conformity with State and Federal regulations.
Elective	255.	be able to keep and analyze farm records, understand the function of farm financing, credit and insurance programs, markets and marketing of farm produce, farm contracts and water rights and the utilization and supervision of labor.

Agricultural Technology continued

B S	F	ET 216.	have a working knowledge of the elements of Psychology. have a general knowledge of human behavioral patterns including both normal and abnormal behavior, in terms of personality and/or individuality. have an understanding of the meaning and practical application of human behavior in the modern industrial environment. know his/her position in relationship with industry.
S		ET 204.	have a basic understanding of the problems and principles of industrial safety organization and management.
S		ET 319.	perform on-the-job experiences under the supervision of qualified trade personnel.
F	M	EL 154.	understand electrical theory, to include series and parallel circuits, practice in use of meters; practical experience in stringing wire and installing various outlets; practical experience in bending and installing conduits.
M		DI 114.	know how to construct, operate, and repair gasoline and diesel engines; know how to use the tools and equipment and logical steps of procedure for engine reconditioning.
M		DI 115.	understand the procedure involved in the operation and maintenance of diesel engines.
M		DI 217.	be introduced to fuels and the principles of operation and maintenance of fuel injection systems including carburetors, fuel pumps, injectors, governors, and control units; trouble shooting, diagnosis and testing of fuel systems.
F	M	IA 218.	gain experience in sharpening, care, repair, and preventative maintenance of hand tools, portable electric tools and industrial equipment; grinding wheel selection and care, development of maintenance records.

F	M	IA 240.	have an understanding of AC and DC welding, types of welders; types of electrodes and characteristics of operation. have practice in the preparation of joints, striking arcs and welding ferrous metals.
F	M	IA 246.	know the procedure for proper care and use of welding equipment, generators, regulators, torches, tanks and manifolds.

AUTOMOTIVE TECHNOLOGY

Key to abbreviations:

A Auto Body Service Technician
B Bachelor of Science Degree
S Auto Service Technician

Programs required for	Course No.	Performance Goal
		The student will:
Elective	110.	be able to read and interpret industrial blueprints as they pertain to the mechanical trades.
Elective	114.	know the basic theory and principles of two and four-stroke engines. be able to service, repair, and recondition small bore engines; units including: heads, cylinder blocks, pistons, camshafts, valves, fuel systems, electrical systems, crankshafts, cooling systems, and lubricating systems.
B	117.	know the basic theory and principles of gearing, be able to service, repair and recondition the automotive power train which will include clutches, transmissions, overdrives, universals, drive shafts, differentials, and rear axles.
B S	119.	make a study of the braking systems employed on automobiles and light trucks. know the theory of operation, construction, maintenance, diagnosis, and repair of drum and disc brake systems.
B S	120.	know the theory of operation, construction features, diagnosis and repair of the vehicle components related to automotive front-end alignment. understand alignment procedures, wheel balancing, automotive springs, shock absorbers, headlight aiming, and be able to visually recognize vehicle frame damage.

Automotive Technology continued

B S	121.	be familiar with the design, operation, trouble shooting and service procedures of modern gasoline engines. participate in the disassembly and reassembly of an engine.
B S	122.	know the basic theory and principles of internal combustion engines, service, repair and maintenance with emphasis on heads, cylinders, blocks, piston, camshafts, valves, fuel systems, lubricating systems and cooling systems.
A	141.	understand automobile body construction, tools, and equipment and repair and repaint procedures.
A	142.	understand theory of automobile body metals and their repair. practice repair and repainting of automobile bodies.
A	143.	understand the theory of automobile finishing and practices required in their application. will practice automobile repair and repainting.
Elective	215.	know the theory and practices of cold and hot automotive frame straightening and be able to select, care for and use the proper tools.
S	225.	be able to work with machining tools, such as boring bar, honing machines, piston knurler, and cylinder head equipment.
B S	234.	know the basic electrical theory of automotive electrical systems. be able to operate, construct and test automotive electrical components.
B S	236.	know the automotive fuels, fuel systems and anti pollution devises used in the automotive industry.
B S	237.	use modern testing equipment in diagnosing and repairing automotive vehicles.
A	241.	understand the theory and practice of automotive body and painting estimates.

Automotive Technology continued

A	242.	understand the theory of automotive glazing and interior and exterior trim. gain experience in automobile body repair and repainting.
A	243.	understand the theory of automobile body panel replacement and alignment. gain experience in automobile body repair and repainting.
Elective	249.	work under regular employment conditions with college supervision.
Elective	300.	know the responsibilities, problems, challenges, and opportunities of a service manager, including job knowledge, leadership skills, and the needs of management.
B S	305.	participate in the disassembly and reassembly of selected transmissions to develop an understanding of the function, construction, operation, servicing, and trouble shooting procedures.
B S	307.	gain additional training in all phases of automotive maintenance and repair.
B	314.	understand the theory and application of hydraulics used in the automotive, agricultural, heavy equipment and construction industries with emphasis on the physical laws, oils, controls, pumps, cylinders, piping, valves and circuits.
Elective	400.	be able to select and requisition equipment for an automotive shop with emphasis on cost, quality, floor space, maintenance, repair costs and installation of equipment.
Elective	404.	have an understanding of petroleum products and their application to the fuel and lubricating requirements of automotive vehicles. perform laboratory tests related to octane, violatility, viscosity, carbon residue, API degree and dropping point of greases.
Elective	405.	know the theory and application of gasoline and diesel fuel systems and make an in-depth study of fuel characteristics, injectors, combustion chambers, injector pumps, metering principles, carburetion, and fuel pumps; their performance and application.

Automotive Technology continued

B		406.	know the theory of refrigeration and air conditioning equipment in automobiles with emphasis on servicing and repairing mobile equipment.
B	S	DR 116.	know basic utilization purposes for industrial drawings detail and assembly. demonstrate skill in the techniques of shop sketching, lettering and specification. know methods of and procedures for the use of drafting instruments, geometric construction, lettering, technical sketching and shape description, multiview projection, inking procedures and duplication processes.
A		ET 216.	have a working knowledge of the elements of psychology. have a general knowledge of human behavioral patterns including both normal and abnormal behavior, in terms of personality and/or individuality. have an understanding of the meaning and practical application of human behavior in the modern industrial environment. know his/her position in relationship with industry.
A		IA 240.	have an understanding of AC and DC welding; types of welders; types of electrodes and characteristics of operation. have practice in the preparation of joints, striking arcs and welding ferrous metals.
A		IA 246.	know the procedure for proper care and use of welding equipment, generators, regulators, torches, tanks and manifolds.
A		IA 285.	know how to make molds for and use injection molding, compression molding, rotational molding and vacuum forming equipment, welding thermo-plastics; fabricating and machining of plastics.
A		IA 344.	develop skills in welding common metals, with emphasis on alloys including inert gas welding.
B		VT 300.	analyze trades and jobs to determine skills and related technical information needed to determine contents for a course of study.

Automotive Technology continued

B	VT 320.	develop an appreciation of our social and economic values of all forms of vocational education in our democracy and the provisions for vocational education in our educational system.
B	VT 325.	know the methods, devices, and procedures used effectively by the instructor in teaching vocational subjects, including lesson planning.
B	VT 424.	know the basic principles underlying the development of instructional materials for job training and develop a course of study.
B	VT 426.	know shop organization and control methods which promote efficiency in control of instruction, equipment, and material. know the process of selecting and purchasing tools, materials, and equipment.
B	VT 430.	have an understanding of the meaning, purpose and need for vocational guidance; basic assumptions and working principles, collection and dissemination of occupational information; placement and follow-up; organization and administration of the guidance program.

The Automotive Technology Department staff has also chosen to use materials developed by the Division of Vocational Education, Alabama State Department of Education and the United States Office of Education, Division of Manpower Development and Training; Howard A. Matthews, Director.

COSMETOLOGY

The Cosmetology Program at Northern Montana College provides students with the knowledge and skills necessary to perform in the profession. Students receive practical experience and theory in all of the following:

Ethics, Sales and Grooming
Cosmetic Chemistry
Shop Management, Business Methods, Law
Rules and Regulations, and Shop Etiquette
Hair Cutting
Shampoo - Rinses
Perms
Scalp Treatment
Facials and Make-up Architecture
Manicures
Dyes: Bleach, Lash and Brow Dye
Pin-Curls, Finger Waving, and Styling

Performance Goals

General

The student will:

1. demonstrate knowledge of State Board Laws, Rules, and regulations.
2. demonstrate comprehensive knowledge of the textbook.
3. demonstrate basic knowledge of personal, professional, and business ethics.

Ethics, Sales, and Grooming

The student will:

1. know the information discussed in the text covering ethics, sales, and grooming.
2. form habits of always appearing properly attired for class and lab.
3. demonstrate knowledge and use of basic personal hygiene.
4. know the Code of Ethics of the National Hairdressers and Cosmetologists Association.
5. know the essentials of good salesmanship.
6. demonstrate the ability to perform the duties of a receptionist including: telephone courtesy, appointment breaking, assignment of extra work duty, handling complaints and intra-operation friction.

Cosmetic Chemistry

The student will:

1. know the theory and composition of chemicals used in cosmetic creams, make-up, color work, permanent waving, sanitation and nutritional chemistry.
2. know the chemistry of hair and skin (PH of hair and skin).
3. demonstrate and apply knowledge of cosmetic chemistry when testing of bleaching hair, giving (a) facials, (b) permanent waves, and (c) disinfecting utensils and work areas.
4. be able to recognize allergic reactions to cosmetic preparation.

Shop Management - Business Methods, Law Rules and Regulations, Shop Etiquette

The student will:

1. demonstrate a professional attitude toward all aspects of management and observation of federal, state, and local laws.
2. have knowledge of types of business management including corporate relationships, and partnerships.
3. exhibit telephone courtesy.
4. exhibit adequate social graces (welcoming, building a salon atmosphere).
5. have knowledge of business relationships within the community, i.e., credit use, obtaining insurance, malpractice, fire, liability, loans and bankruptcies.
6. develop bookkeeping knowledge from vocational-technical bookkeeping.
7. demonstrate knowledge of mathematics applicable to shop management.

Hair Cutting

The student will demonstrate ability to:

1. do a neckline haircut with a razor without a guard.
2. use a razor with a guard.
3. use of scissors.
4. use tapering shears.
5. execute specialized or customized cuts and cushioned cuts.

Cosmetology continued

6. perform precission cuts for blow combing.
7. do both long and short haircuts.
8. apply major principles of textures and conditions of the hair for preperming haircuts.

Shampoos and Rinses

The student will:

1. have an understanding of the various types of shampoos compatable with the various types of hair textures.
2. demonstrate and form a habit of always testing the water for preshampooing.
3. display an understanding of rinses compatible and suitable for hair textures.
4. have a knowledge and understanding of uses and application of various color rinses.
5. display the manipulations involved in good shampoo and rinses.
6. execute at least 50 hours in shampoos and rinses.
7. demonstrate what constitutes a good water rinse.

Permanents

The student will:

1. view a historical demonstration of old machine and machineless permanent methods and learn about the development of permanent waves.
2. practice various types of permanent wave wraps.
3. demonstrate and use at least four different types of cold wave perms according to manufacturer's instructions.
4. give at least one machineless type of permanent such as uniperm, and miniwave perm.
5. have experience with both acid and alkaline balance perm.
6. give at least one organic perm.
7. have knowledge of the chemistry of permanent wave lotions and hair reaction and accurately judge or test curl.
8. learn to choose the proper lotions for machineless perms.

Cosmetology continued

Scalp Treatment

The student will:

1. know the anatomy and physiology of the skull and scalp.
2. know the finger manipulations necessary for a good scalp treatment.
3. demonstrate proficiency with the use of the vibrator and ultraviolet apparatus.
4. recognize scalp disorders, inflamations, and diseases and will differentiate between those disorders which must be treated by a physician or can be treated by the cosmetologist.
5. have a knowledge of scalp preparation which can be used in conjunction with scalp treatments to treat dandruff, promote health, and assist in delaying baldness.
6. have a knowledge of the various electrical apparatus used for scalp treatment and faradic, galvanic, and tesla, and short wave currents.
7. know the various uses of packs and compresses.

Facials and Make-Up

The student will:

1. be aware of several types of corrective facials such as milia, acne, and muscle strapping.
2. know the basic simple cleansing facial and the proper finger manipulations necessary for a toning facial.
3. know the muscle structure, nerve and blood supply of the face and head.
4. know the instructions, use, and applications of various mosques.
5. be aware of various electrical applications and their uses.
6. know the use of visible light rays in facial treatments, eg. blue, white, etc.
7. know the various uses of packs and compresses.
8. recognize certain skin disorders and diseases and apply treatment or refer to physician.
9. be aware of the standard cosmetic preparations and their applications.
10. be cognizant of the various coloring materials and perfumes which may cause allergic reactions.
11. have knowledge of various face shapes and the proper daytime, street, evening, fantasy, and stage-television make-up as well as corrective make-up for facial scarring and post surgery.

Cosmetology continued

Manicure

The student will:

1. know the anatomy and physiology of the extremities.
2. know the various shapes of the nails.
3. know the various disorders and diseases of the nails and refer when necessary to a physician.
4. know the chemistry and cosmetics appropriate and healthful for the nails.
5. practice the hand-arm-foot-leg manipulations.
6. perform the main types of manicures: plain, oil lactal, electric and mitt.
7. perform male manicures and booth manicures.
8. exhibit proper use of various electrical equipment for services.

Dyes: Bleach, Lash and Brow Dye

The student will:

1. know hair structures.
2. know chemistry of vegetable, metallic compounds and aniline dyes and bleaches.
3. coordinate colors for the patron's needs. (i.e., life style, flesh tones, etc.)
4. use proper salesmanship and counseling techniques.
5. use proper application for virgin bleaches, tints, and retouches.
6. know the proper use and composition of solutions associated with fillers, and shampoos.
7. recognize the dangers inherent in lash and brow dying.
8. know the proper application of lash and brow dye.

Pin Curls, Finger Waving and Styling (PCFW)

The student will:

1. differentiate the hair textures and conditions.
2. know the anatomy and physiology of the skin and scalp and the nutrition of the hair.
3. have a knowledge of the different lengths of hair and appropriate applications.
4. possess the basic knowledges and skills which will meet state board requirements for licensing.
5. know the mistability and application of all the various styling tools. (i.e., blowcombing, etc.)

Cosmetology continued

6. have exposure to the various styling techniques to include:
   a. finger waving,
   b. geometrical shapings and bares,
   c. core and straight rollers,
   d. volume and indentation,
   e. insertation of pincurls,
   f. setting controls.
7. use various hair cosmetics, setting lotions, and holding lotions.

DRAFTING

Key to abbreviations:

A Associate Degree
B Bachelor of Science Degree
C One-Year Certificate

Programs required for	Course No.	Performance Goal
		The student will:
A B C	103.	know the free-hand techniques of orthographic and pictorial drawings.
A B C	105.	show an awareness of the various types of drafting media and reproduction processes as found in a drafting or engineering office, to include various papers, vellum, cloth and film along with reproduction processes such as xerox, thermofax, ditto, diazordy, multilith, microfilming.
Elective	111. 112.	apply basic concepts of lettering, geometric construction, multiview drawing, pictorial drawings, auxiliary views, intersections, developments, detail and assembly drawings, construction drawings, schematics, and symbologies.
A B C	115.	demonstrate a knowledge of the standard practices for detailing reinforced concrete structures, including placing drawings, reinforcing bar lists, bending diagrams.
Elective	116.	know basic utilization purposes for industrial drawings detail and assembly. demonstrate skill in the techniques of shop etching, lettering and specification. know methods and procedures of and demonstrate skill in the identification of dimensions, tolerances, standards, order of assembly, materials, schematics of operation and terminology.

Drafting continued

Elective	121.	know basic concepts on the history of the graphic language. know basic methods and procedures for the use of drafting instruments, geometric construction, lettering, technical sketching and shape description, multiview projection, inking procedures and duplication processes.
Elective	122.	understand facts and principles of orthographic projection and its application to drafting. solve problems on point, line and planes with application to engineering and industrial problems.
Elective	123.	understand the theory and related practices in the development of drawings necessary to produce and assemble consumer equipment and goods. demonstrate drafting skills in sectional views, dimensioning, tolerancing, fasteners, welding drawings and welding symbols.
Elective	124.	understand drafting procedures, drawing practices, drafting room routine, components in electronics, fastening and driving components, materials and finishes, and general electronic design.
Elective	125.	understand basic concepts relating to sectional views and dimensioning as well as drawing interpretation, welding symbols, and welding drawings.
A B	131.	understand basic concepts of engineering drawing. know principles of the history of the graphic language. know methods and procedures for the use of drafting instruments, geometric construction, freehand and LeRoy Lettering, shape description, multiview projection, inking procedures, drafting room techniques and industrial practices.
A B C	132.	know the facts and principles of orthographic projection and its application to solutions of problems in drafting. recognize problems on the point, line and plane with applications to engineering and industrial problems.

Drafting continued

A B	133.	understand the theory and related practices of the drafting room inherent in the industrial production of machines goods. demonstrate drafting skills in developing sectional views, dimensioning, tolerancing, fasteners, welding drawings and welding symbols.
C	136.	demonstrate a knowledge of the planning and drawing of framed dwellings.
C	141.	demonstrate an application of the fundamentals of engineering drawing, history of the graphic language, use of drafting instruments, geometric construction, freehand and LeRoy Lettering, shape description, and multiview projection, inking procedures, drafting room techniques and industrial practices.
C	143.	apply theory to related practices in the drafting room inherent in the industrial production of machine goods.
A B	204.	understand the development and function of uniform building codes and the study of a nationally organized set of minimum property standards.
A B	205.	know basic concepts in the design of cams, gears, belting, and pulleys, chain transmissions, special threads, fasteners, springs, keys and keyways, splines and shafts, surface finishes, symbol application, detail and assembly drawings.
A B	206.	know methods and procedures for computing loads on the various structural members commonly used in buildings understand the various methods used in selecting structural members to withstand the given forces.
A B	208.	know basic principles for the planning and design of structures, with emphasis on residential.
C	220.	understand facts and principles related to conventional practices and current standards as used in graphic portrayal of electronic circuits and equipment.

Drafting continued

A B	234.	know methods and procedures for planning, designing and the layout of a complete wiring system for a house. recognize electrical design problems pertaining to small commercial type buildings. demonstrate possession of a working knowledge of the methods used to install a complete wiring system for a small commercial building.
A B	235.	know basic concepts of structural materials and their various combinations, including steel shapes, built-up members, reactions, connections, diagrams and steel detailing for reinforced concrete.
A B	236.	demonstrate skill in obtaining data for maps. demonstrate a skill in topography including surveying, field notes, reducing notes, balancing traverses, using maping machines, planimeters and calculators.
A B	237.	solve problems involving standards and techniques specific to architectural planning and structural design with emphasis on applications to residential construction.
A B	238.	understand the fundamentals of pipe drafting including symbols and layouts.
B	306.	judge the correlation between actual standards and the presentations of various authors.
Elective	309.	show an awareness of the techniques and characteristics of perspective drawing and axonometric, or paraline, drawing and projections to improve and broaden the utilization of graphic methods.
Elective	320.	demonstrate a knowledge of the use of graphic techniques, such as shade and shadow drawing, whereby certain features of objects and forms displayed in multiview or pictorial drawings may be accented to improve visual interpretation.

Drafting continued

Elective	327.	demonstrate a knowledge of the techniques of pattern development preparing for work involving construction of geometric forms and the necessary layouts, transitions, and intersections.
B	349.	perform skillfully in the teaching of drafting subjects, evaluating drawings or in related duties pertaining to other curricular activities of the classroom teacher.
Elective	400.	study revolution and rotation; coplaner and non-coplaner vectors; developments and intersections of 3-D figures or objects; geologic and topographic determinations. apply the general theories of descriptive geometry to various phases of engineering industrial and mechanical problems.
Elective	405.	know methods and procedures for using pencils, pen and ink, air brush, color wash, etc. in the process of pictorial rendering. recognize shades and shadows, and the uses of various coloring media. know basic concepts of color theory.
Elective	408.	know methods and procedures for the use of various types of graphic projections and views necessary to portray pictorially correct assembly and installation procedures.
Elective	410.	evaluate and perform skillfully the newer methods, techniques, materials and equipment used in the teaching of drafting.
Elective	414.	understand the proper delineation of drawings for patent application and related general information concerning patents.
A B	EN 241.	have a fundamental theory of surveying and practice notekeeping and have an understanding of linear measurements with emphasis on angle reading, differential leveling, set ups of transit and level, and computations of elementary surveying problems.
A C B	ET 101.	gain an insight into values important to his chosen field and the "real world" conditions.

Drafting continued

A B	C	ET 170.	know the fundamentals of carpentry construction covering layout of site, foundation form work, concrete framing, walls, flooring systems, roofs, interior-exterior finishing, stair layout, insulation and moisture control, door and window construction.
A	B	ET 211.	study the cost analysis of building plans and construction project through application of accepted estimating techniques, to include quantity extraction, pricing, labor expansion, profit and applied overheads.
A	B	EL 154.	understand electrical theory, to include: series and parallel circuits; practice in use of meters; practical experience in stringing wire and installing various outlets; practical experience in bending and installing conduits.
B		VT 300.	analyze trades and jobs to determine skills and related technical information needed to determine contents for a course of study.
B		VT 320.	develop an appreciation of our social and economic values of all forms of vocational education in our democracy and the provisions for vocational education in our educational system.
B		VT 325.	know the methods, devices, and procedures used effectively by the instructor in teaching vocational subjects, including lesson planning.
B		VT 424.	know the basic principles underlying the development of instructional materials for job training and develop a course of study.
B		VT 426.	know shop organization and control methods which promote efficiency in control of instruction, equipment and material, know the process of selecting and purchasing tools, materials, and equipment.
B		VT 430.	have an understanding of the meaning, purpose and need for vocational guidance; basic assumptions and working principles, collection and dissemination of occupational information; placement and follow-up; organization and administration of the guidance program.

ENGINEERING TECHNOLOGY

Key to abbreviations:

- A Electronics Technology (Communications Option)
- B Bachelor of Science Degree
- C Construction Engineering Technology (Civil Option)
- E Electronics Engineering Technology (Associate Degree)
- I Mechanical Engineering Technology (Industrial Option)
- M Mechanical Engineering Technology (Mechanical Option)
- L Electronics Technology (Associate Degree)
- O Construction Engineering Technology (Building Option)
- T Electrical Technology
- V Electronics Technology (TV Option)

Programs required for	Course No.	Performance Goal
		The student will:
I M	100.	have an understanding of the theory of the slide rule as based on logarithms with practice in reading the various scales of the rule and solving practical problems through its use.
C I M O	101.	gain an insight into values important to his chosen field and the "real world" conditions.
A E L T	124.	have a basic understanding of machining with emphasis on engine lathe, bandsaw, milling machines, shaper, drill press, and surface grinder.
A B E L T V	151.	know basic electrical theory and electrical units. know Ohm's law, Kirchoff's law, and basic network theorems including Thevenin's theorem and Superposition. know the basic theory of magnetism and magnetic circuits and be able to use common DC measuring and metering equipment and perform elementary slide rule operations.

Engineering Technology continued

A L	B T	E V	152.	know the characteristics of AC currents and voltages, inductance and capacitance in AC circuits and the phase and power factor. have a basic understanding of three-phase systems.
A L	B T	E V	155.	know the principles of active devices such as electron tubes, semi-conductor diodes, bipolar transistors, field effect transistors, and thyristors. know the basic applications of active devices to electronic circuits; rectification, tube and transistor amplifiers.
A L	B T	E V	156.	understand the philosophy of measurement applied to electrical circuits. know significant figures, accuracy of electrical measuring equipment, basic electrical standards of resistance, voltage, current and time.
C M	I O		170.	know the fundamentals of carpentry construction covering layout of site, foundation form work, concrete framing, walls, flooring systems, roofs, interior-exterior finishing, stair layout, insulation and moisture control, door and window construction.
C M	I O		204.	have a basic understanding of the problems and principles of industrial safety organization and management.
O			205.	show an awareness of the supervision of appropriate safety measures and techniques to safeguard techniques personnel in the use of tools and equipment including hazard reduction apparel and aids.
M			206.	understand the theory and fundamentals pertaining to electrical and lighting systems as applied to various facilities.
O			207.	survey mechanical and electrical installations common to various facilities.
C	O		211.	study the cost analysis of building plans and construction projects through application of accepted estimating techniques, to include quantity extraction, pricing. labor expansion, profit and applied overheads.

Engineering Technology continued

C	214.	know the design, expansion and construction as well as approved methods of testing, conveying, placing, curing and finishing concrete. know asphalt mixtures and be able to apply tests for viscosity, penetration, ductility and flash.
C	215.	know the composition and physical properties of soils for construction purposes and the testing and classifying of such soils. know the causes of support failure and methods of support improvement.
I O	216.	have a "working" knowledge of the elements of psychology. have a general knowledge of human behavioral patterns including both normal and abnormal behavior, in terms of personality and/or individuality. have an understanding of the meaning and practical application of human behavior in the modern industrial environment. know his/her position in relationship with industry.
C O	218.	know procedures and guides applicable to field inspection of construction facilities.
O	219.	be introduced to manufacture, supply, distribution, and marketing together with a detailed study of common groupings and arrangements of materials and products produced by the allied industries and their application to construction.
C	225.	understand surveying principles with related fields application including office computations, utilizing conventional and electronic calculating devices.
Elective	226.	have a basic understanding of thermo-dynamics, the operation and properties of boilers, turbines, spark ignitions, and compression ignition engines.
M	228.	know heat transfer, insulation, heating, venting and airconditioning systems and duct work as it applies to heat and air-conditioning.

Engineering Technology continued

I	230.	have an understanding of vectors, force systems, friction, centroids, moments of inertia, analysis of machine motions, masses, accelerations and dynamic forces.
L V	234.	understand basic theory covering super-heterodyne radio-laboratory to develop use of necessary test equipment and diagnostic techniques.
L V	235.	develop trouble shooting techniques for radio and audio equipment.
L V	239.	know the basic circuity used in black and white and colored TV.
L V	248.	know the theories and principles applied to the circuity used in black and white and colored TV.
Elective	249.	apply the trouble shooting and servicing techniques on black and white and colored TV.
Elective	266.	make a study of the proper care and use of hand tools, soldering, filing, tapping and threading.
A B E L T V	271.	know the design and analysis of semi-conductor and vacuum tube amplifiers. understand amplification theory including response, positive and negative feed-back and frequency compensation of amplifier net works. study the effects of cascaded amplifiers.
A B E L T	272.	have a basic understanding of non-sinusodal circuit analysis with emphasis on clamps, clippers, limiters, multi-vibrators, and the Schmitt trigger.
A B E T	273.	have a basic understanding of the funda-mentals of digital circuits with emphasis on binary, octal, hexadecimal number systems and boolean algebra.
A B E L V	274.	know printed circuit techniques and be able to design and construct printed circuit boards.

Engineering Technology continued

A E V	276.	be introduced to DC power supply design, rectification of AC power supply regulation including series and shunt regulators to DC and AC inverters and DC to DC convertors and switching regulators.
A B E	281.	have a basic understanding of communication as it relates to modulation and demondulation principles of amplitude modulation (AM), frequency modulation (FM) phase modulation (PM) and continous wave modulation (CW).
A B E	282.	have an understanding of communication with emphasis on pulse, modulation, band width requirements, noise, and data transfer rate. be able to use the spectrum analyzer.
A B E L V	285.	have a basic understanding of microwave principles and measurements with emphasis on transmission lines, wave guides, energy sources, and the measurement of VSWR, power, frequency, wavelength, and the errors in such measurements.
A B E L V	286.	present discussions on the manufacture of solid state devices used in electronics.
Elective	301. 302.	know the elements of engineering materials as they apply to building structures and components.
M	311.	be able to make a practical design and layout of plumbing.
M	312.	make a study of building plans with emphasis on mechanical layout. incorporate practical experience in mechanical design layout.
C	314.	understand the theory of engineering and be able to make practical applications of various types of drawing, engineering and surveying problems.
Elective	315.	know the design and layout of commercial and public structures.
Elective	316.	be able to design reinforced concrete and to know the methods of detailing, computing, and fabricating the steel.

Engineering Technology continued

C M O	317.	be able to interpret the specifications accompanying various plans, their legality, phraseology, and content, with emphasis on materials, methods and pay quantities.
O	318.	understand how working conditions are affected by contracts, rules and instruments of employment and their validity, and recognize national ramifications as they effect and are affected by the al ied industry.
Elective	319.	perform on-the-job experiences under the supervision of qualified trade personnel.
I M	321. 322.	make an investigation of stress and deformation in structural members, stresses and strains, torsion and deflection of machine elements. have a basic understanding of the strength of materials in relation to loads on structural units, joints, beams, columns, and total structure.
C I	328.	be able to apply testing procedures to determine the physical strength of structural materials and identify the mechanical elements.
I	334.	have an understanding of basic manufacturing processes, plastics, ceramics, pattern making and foundry processes with emphasis on heat treatment of metals.
I	335.	have a basic knowledge of the theory and practice of fluid machines.
I M	336.	make a general survey of recording and indicating instruments and control devices and be able to treat those devices using electrical and fluid systems for both manual and automatic control.
B E	341. 342. 343.	work in an industry oriented laboratory, design, construct, test, and report on a project.
B E	371.	have an understanding of the arithmetic unit, registers, main memory and input-output devices of the digital computer.

Engineering Technology continued

B E	372.	make a continual study of Digital Systems I including the peripheral devices used with computer systems.
B E	373.	know current topics in digital electronics.
O	381.	be introduced to the accepted production methods, systems, placement techniques, and anillary aids required for installation of materials in the completion of today's facilities.
O	382.	make a continual study of Construction Techniques I, with investigations into clerking, shop drawings, hardware, and miscellaneous connections and connectors, welding and fasteners, schedules, and scheduling, including monthly progress payments, production, and C.P.M.
Elective	400.	know electronic principles as they apply to the reception of monochromatic visual and frequency modulated aural information.
Elective	404.	make a continual study and exploration of television reception with the addition of color reception.
Elective	405.	have an understanding of the basic and advanced principles of telecasting.
Elective	406.	know the relationships of TV to electromagnetically-radiated visual and aural information, both monochrome and chrominance and make an in-depth study of the applications of closed-circuit television as related to education.
B	441. 442. 443.	work in an industrial oriented laboratory where the student will design, construct, test, and report on a project.
Elective	EN 100.	attend lectures that introduce engineering as a career.
O	EN 241.	have a fundamental theory of surveying and practice notekeeping and have an understanding of linear measurements with emphasis on angle reading, differential leveling, set ups of transit and level, and computations of elementary surveying problems.

Engineering Technology continued

Elective	EN 242.	have experience in traverse surveying, elementary mapping, determination of true meridian, ciruclar curves, profiles and do field work.
Elective	EN 243.	have an understanding of engineering astronomy, route surveying, construction surveying, trangulation and field problems.
C I M O	DR 103.	know the free-hand techniques of orthographic and pictorial drawings.
C I M O	DR 105.	show an awareness of the various types of drafting media and reproduction processes as found in a drafting or engineering office, to include various papers, vellum, cloth and film along with reproduction processes such as xerox, thermofax, ditto, diazordy, multilith, microfilming.
C O	DR 115.	demonstrate a knowledge of the standard practices for detailing reinforced concrete structures, including placing drawings, reinforcing bar lists, bending diagrams.
A B E L T	DR 124.	understand drafting procedures, drawing practices, drafting room routine, components in electronics, fastening and driving components, materials and finishes, and general electronic design.
C I M O	DR 131.	understand basic concepts of engineering drawing. know principles of the history of the graphic language. know methods and procedures for the use of drafting instruments, geometric construction, freehand and LeRoy Lettering, shape description, multiview projection, inking procedures, drafting room techniques and industrial practices.
C I M O	DR 132	know the facts and principles of orthographic projection and its application to solutions of problems in drafting. recognize problems on the point, line and plane with applications to engineering and industrial problems.

Engineering Technology continued

C M	I O	DR 133.	understand the theory and related practices of the drafting room inherent in the industrial production of machined goods. demonstrate drafting skills in developing sectional views, dimensioning, tolerancing, fasteners, welding drawings and welding symbols.
C O	M	DR 204.	understand the development and function of uniform building codes and the study of a nationally organized set of minimum property standards.
I		DR 205.	know basic concepts in the design of cams, gears, belting, and pulleys, chain transmissions, special threads, fasteners, springs, keys and keyways, splines and shafts, surface finishes, symbol application, detail and assembly drawings.
C		DR 206.	know methods and procedures for computing loads on the various structural members commonly used in buildings. understand the various methods used in selecting structural members to withstand the given forces.
B L	E T	DR 220.	understand facts and principles related to conventional practices and current standards as used in graphic portrayal of electronic circuits and equipment.
M		DR 238.	understand the fundamentals of pipe drafting including symbols and layouts.
T		EL 261.	understand the fundamental concepts of small DC and AC machines; power generation single-phase and three-phase motors, transformers, and regulators.
T		EL 262.	study the theory of design and operation of electrical power systems, distribution systems, transmission lines, plant distribution, protective devices, load analysis and economics.
T		EL 263.	understand the basic concepts of industrial control, motor control and machine control, including speed controllers, starters, synchros, and magnetic amplifiers.

Engineering Technology continued

I	IA 140.	develop skill in welding common metals.
E I	IA 244.	know the field of Industrial Arts Education from early history to current practices.
B	VT 300.	analyze trades and jobs to determine skills and related technical information needed to determine contents for a course of study.
B	VT 320.	develop an appreciation of our social and economic values of all forms of vocational education in our democracy and the provisions for Vocational Education in our educational system.
B	VT 325.	know the methods, devices, and procedures used effectively by the instructor in teaching vocational subjects, including lesson planning.
B	VT 424.	know the basic principles underlying the development of instructional materials for job training and develop a course of study.
B	VT 426.	know shop organization and control methods which promote efficiency in control of instruction, equipment and material, know the process of selecting and purchasing tools, materials, and equipment.
B	VT 430.	have an understanding of the meaning, purpose and need for vocational guidance; basic assumptions and working principles, collection and dissemination of occupational information; placement and follow-up; organization and administration of the guidance program.

INDUSTRIAL ARTS

Key to abbreviations:

A Broadfield Major (Automotive Option)
B Bachelor of Science (major)
D Broadfield Major (Drafting Option)
E Broadfield Major (Electronics Option)
M Broadfield Major (Metals Option)

Programs required for	Course No.	Performance Goal
		The student will:
A B D E M	105.	understand the fundamental principles of design applicable to tools, processes, and materials involved in the industrial arts.
Elective	108.	know how to plan and execute integrated handwork activities in the classroom to include projects in wood, leather, plastic, metal and lettering.
A B D E M	131.	develop skills in the use and care of hand tools with emphasis on identifying common woods, measuring lumber and knowing safe working practices.
A B D E M	132.	know the fundamentals of woodworking machinery, combination operations, methods of production, correct use of joints, adhesives, electronic gluing, and wood laminating.
B	140.	develop skill in welding common metals.
A B D E M	144.	understand the fundamental hand and machine tool operations; care and maintenance of sheet metal equipment. develop patterns involving parallel and radial lines, techniques and typical industrial application.

Industrial Arts continued

A E	B M	D	154.	prepare wood and metal surfaces for the finish, the application of stains, fillers, sealers and bleaches; spraying and brushing paints, varnishes, lacquers and penetrating finishes for wood.
A E	B M	D	180.	be introduced to leather, plastics and art metal.
A E	B M	D	213.	gain experience in sharpening, care, repair, and preventative maintenance of hand tools, portable electric tools and industrial equipment; grinding wheel selection and care, development of maintenance records.
A E	B M	D	224.	know the field of Industrial Arts Education from early history to current practices.
A E	 M	D	240.	have an understanding of AC and DC welding; types of welders; types of electrodes and characteristics of operation. have practice in the preparation of joints, striking arcs and welding ferrous metals.
A E	 M	D	244.	know how to setup and operate the engine lathe, drill press and pedestal grinder, to include safety, types of machines, precision measuring, threads, taper, and associated cutting tools.
M			245.	know the technical terms, materials, tools and equipment involved in patternmaking and founding; the fundamental process involved in designing and constructing patterns. make and use coreprints, cores and core boxes; prepare sand, ramming molds, prepare and pour metal, and clean castings.
A E	 M	D	246.	know the procedure for proper care and use of welding equipment, generators, regulators, torches, tanks and manifolds.
A E	B M	D	261.	understand the theory of DC and AC electricity. know Ohm's Law, basic and complex circuits, electrical wiring, magnetism, generators, motors, and measuring devices.

Industrial Arts continued

A B D E M	262.	understand basic electronic circuitry, electronic symbols and diagrams, construction of electrical components by stages.
Elective	284.	develop skills in surface decoration, assembly and design, with emphasis placed on carving.
Elective	285.	know how to make molds for and use injection molding, compression molding, rotational molding and vacuum forming equipment, welding thermo-plastics; fabricating and machining of plastics.
M	314.	develop skills in the use of TIG and MIG, resistance and spot welding; use of arc air torch, arc oxygen and carbon.
M	315.	study metals, their composition, structure and properties, and their behavior when exposed to different conditions.
M	319.	design, fabricate and finish welded projects.
Elective	337.	organize, design products, research the market, analyze the operation, tool up for production, produce a product, and evaluate the results.
M	344.	develop skills in welding common metals, with emphasis on alloys including inert gas welding.
Elective	345.	recognize practical shop problems and construct various irregular fittings encountered in the field.
M	346.	understand the theory of welding as applied to aluminum, stainless steel and other alloys.
M	347.	know how to setup and operate the shaper, milling machine, surface grinder, vertical power saw and the turret lathe, to include feeds, speeds, surface finish, workholding devices and associated cutting tools.

Industrial Arts continued

D	374.	apply the fundamentals of carpentry including construction of wall sections in fullsize, survey and stake out the building, concrete form construction; floor wall and room framing, layout of rafters and stairs.
Elective	376.	develop skills in the use of tools and machines, with emphasis on drawer and door construction and plastic laminates.
Elective	385.	develop skills in forming, raising, etching, tooling, engraving, spinning, and enameling.
A	AT 114.	know the basic theory and principles of two and four-stroke engines. be able to service, repair, and recondition small bore engines; units including: heads, cylinder blocks, pistons, camshafts, valves, fuel systems, electrical systems, crankshafts, cooling systems, and lubricating systems.
A	AT 117.	know the basic theory and principles of gearing, be able to service, repair and recondition the automotive power train which will include clutches, transmissions, overdrives, universals, drive shafts, differentials, and rear axles.
A	AT 119.	make a study of the braking systems employed on automobiles and light trucks. know the theory of operation, construction, maintenance, diagnosis, and repair of drum and disc brake systems.
A	AT 121.	be familiar with the design, operation, trouble shooting and service procedures of modern gasoline engines. participate in the disassembly and reassembly of an engine.
A	AT 122.	know the basic theory and principles of internal combustion engines, service, repair and maintenance with emphasis on heads, cylinders, blocks, piston, camshafts, valves, fuel systems, lubricating systems and cooling systems.

Industrial Arts continued

A	AT 234.	know the basic electrical theory of automotive electrical systems. be able to operate, construct and test automotive electrical components.
A	AT 236.	know the automotive fuels, fuel systems and anti pollution devices used in the automotive industry.
D	DR 103.	know the free-hand techniques of orthographic and pictorial drawings.
D	DR 105.	show an awareness of the various types of drafting media and reproduction processes as found in a drafting or engineering office, to include various papers, vellum cloth and film along with reproduction processes such as xerox, thermofax, ditto, diazordy, multilith, microfilming.
A B D	DR 121.	know basic concepts of the history of the graphic language. know basic methods and procedures for the use of drafting instruments, geometric construction, lettering, technical sketching and shape description, multiview projection, inking procedures and duplication processes.
A B D	DR 123.	understand the theory and related practices in the development of drawings necessary to produce and assemble consumer equipment and goods. demonstrate drafting skills in sectional views, dimensioning, tolerancing, fasteners, welding drawings and welding symbols.
D	DR 131.	understand basic concepts of engineering drawing. know principles of the history of the graphic language. know methods and procedures for the use of drafting instruments, geometric construction, freehand and LeRoy Lettering, shape description, multiview projection, inking procedures, drafting room techniques and industrial practices.
D	DR 132.	know the facts and principles of orthographic projection and its application to solutions of problems in drafting. recognize problems on the point, line and plane with applications to engineering and industrial problems.

Industrial Arts continued

D	DR 133.	understand the theory and related practices of the drafting room inherent in the industrial production of machined goods. demonstrate drafting skills in developing sectional views, dimensioning, tolerancing, fasteners, welding drawings and welding symbols.
A B D	DR 136.	demonstrate a knowledge of the planning and drawing of framed dwellings.
D	DR 204.	understand the development and function of uniform building codes and the study of a nationally organized set of minimum property standards.
D	DR 205.	know basic concepts in the design of cams, gears, belting, and pulleys, chain transmissions, special threads, fasteners, springs, keys and keyways, splines and shafts, surface finishes, symbol application, detail and assembly drawings.
D	DR 208.	know basic principles for the planning and design of structures, with emphasis on residential.
D	DR 234.	know methods and procedures for planning, designing and the layout of a complete wiring system for a house. recognize electrical design problems pertaining to small commercial type buildings. demonstrate possession of a working knowledge of the methods used to install a complete wiring system for a small commercial building.
D	DR 236.	demonstrate skill in obtaining data for maps. demonstrate a skill in topography including surveying, field notes, reducing notes, balancing traverses, using maping machines, planimeters and calculators.
D	DR 237.	solve problems involving standards and techniques specific to architectural planning and structural design with emphasis on applications to residential construction.

Industrial Arts continued

D	DR 238.	understand the fundamentals of pipe drafting including symbols and layouts.
E	EN 241.	have a fundamental theory of surveying and practice notekeeping and have an understanding of linear measurements with emphasis on angle reading, differential leveling, set ups of transit and level, and computations of elementary surveying problems.
D	ET 101.	gain an insight into values important to his/her chosen field and the "real world" conditions.
E	ET 151.	know basic electrical theory and electrical units. know Ohm's law, Kirchoff's law, and basic network theorems including Thevenin's theorem and Superposition. know the basic theory of magnetism and magnetic circuits and be able to use common DC measuring and metering equipment and perform elementary slide rule operations.
E	ET 152.	know the characteristics of AC currents and voltages, inductance and capacitance in AC circuits and the phase and power factor. have a basic understanding of three-phase systems.
E	ET 155.	know the principles of active devices such as electron tubes, semi-conductor diodes, bipolar transistors, field effect transistors, and thyristors. know the basic applications of active devices to electronic circuits; rectification, tube and transistor amplifiers.
D	ET 170.	know the fundamentals of carpentry construction covering layout of site, foundation form work, concrete framing, walls, flooring systems, roofs, interior-exterior finishing, stair layout, insulation and moisture control, door and window construction.
E	ET 248.	know the theories and principles applied to the circuity used in black and white and colored TV.

Industrial Arts continued

A D	B	VT 325.	know the methods, devices, and procedures used effectively by the instructor in teaching vocational subjects, including lesson planning.
A D	B	VT 424.	know the basic principles underlying the development of instructional materials for job training and develop a course of study.
A D	B	VT 426.	know shop organization and control methods which promote efficiency in control of instruction, equipment and material, know the process of selecting and purchasing tools, materials, and equipment.

VOCATIONAL-TECHNICAL EDUCATION

The following performance goals are for the graduate courses offered in Vocational-Technical Education.

Course No.	Performance Goals
	The student will:
604.	be familiar with the administrative techniques in vocational education, the types of classes and programs and sources and expenditures of funds.
605.	know the organization, administration, and supervision of cooperative programs.
606.	know principles of teacher-made tests, their validity and methods of making performance-type tests.
607.	know the evolution of vocational education through the people, movements, events, and institutions that contributed to its formulation and development.
608.	know the methods and procedures for determining curriculum content and organization.
610.	have an understanding of adult education in school systems; methods of organizing, promoting, and conducting the programs.
614.	be familiar with the origin of the labor movement and its development in the United States and have an understanding of labor organization.
615.	have an understanding of the philosophical background and basis of vocational education as related to total educational programs.
616.	attend research seminars and conduct research in the field of vocational education.
617.	know the functioning of financial control in a vocational school, including budgeting and school accounting.
618.	know the techniques for community or area surveys to determine possible needs for types of vocational education programs.

Vocational-Technical Education continued

619. attend seminars and discuss problems that arise in the teaching profession and examine approaches to them from the teacher, supervisor, and director levels.

620. be familiar with the factors involved in planning a laboratory facility to provide flexibility and adaptability of space and equipment to a wide range of instructional activities.

624. know the use of psychological methods in personnel management in industry with emphasis on personnel policy formation and techniques in placement, interviewing, efficiency, job evaluation and training, merit rating, morale and safety.

625. have a knowledge of recent federal and state legislation activities, executive rules and regulations that bear directly and indirectly upon vocational education.

626. know the methods of meeting supervisory training needs in vocational education utilizing the conference approach.

627. know the methods and devices for vocational education responsible for improvement instruction through organization, coordination and supervision.

628. make an appraisal of contemporary practices presently available in education and know the means of converting these technologyical advanced into successful teaching tools.

650. gain experience in organizing courses, research, determining course content and developing skill in teaching postsecondary students by working under a master teacher.

655. be aware of current problems and issues in vocational education.

Since a component of the preparation of vocational-technical teachers encompasses professional courses in teacher education, the project staff assisted the Teacher Education Department of Northern Montana College in the identification of professional entry level competencies. The following pages depict graphically and narratively progress achieved. Continual development is forcasted for the 1975-1976 academic year.

Introduction

The teacher education program at Northern Montana College has a major goal, the preparation of teachers who possess professional entry level comptencies. All teacher education students are exposed cognitively, affectively, and experientially to the areas of child growth and development, foundations and current issues, and methods of teaching various curriculum areas. This program is illustrated by the following paradigm:

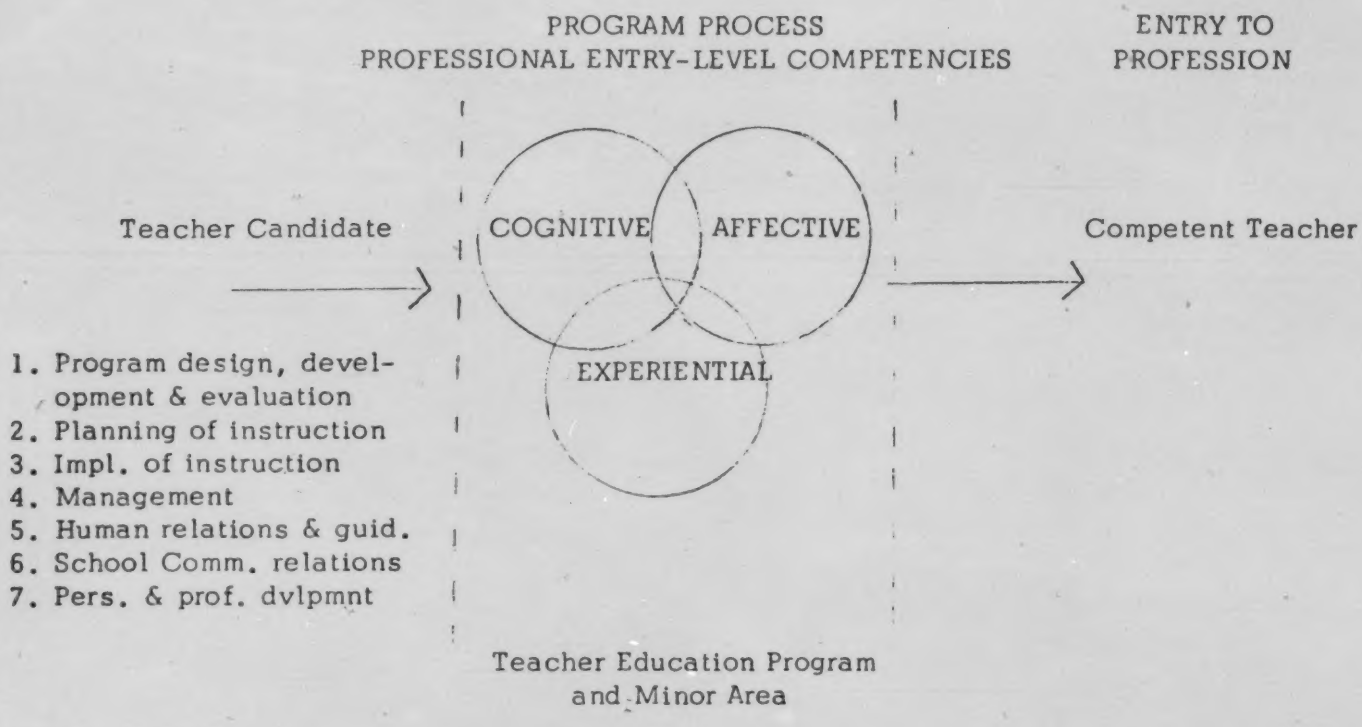

FIGURE 1. Paradigm for Teacher Education Program at Northern Montana College

Definitions:

Professional Entry-Level Competency - refers to those knowledges, skills, and attitudes, identified by the teacher education division at Northern Montana College in conjunction with area educators which are required for entry to the profession.

Cognitive - refers to all knowledge obtained in the areas outlined for professional entry-level competencies.

Affective - refers to attitudes and values possessed by prospective teachers exiting the teacher preparation program or its various components.

Experiential - refers to all practical experiences provided for students which develop professional entry-level competency. For example, field experiences in reading methods, student teaching, etc.

Professional Entry-Level Competencies

The identified professional entry-level competencies were arranged into seven interrelated areas. These areas are modifications of areas employed by Ohio State University (Cotrell) and Wayne State University.

Areas for Professional Entry-Level Competencies

1. Program design, development and evaluation
2. Planning of instruction
3. Implementation of instruction
4. Management
5. Human relations and guidance
6. School community relations for teacher
7. Personal and professional development

PROFESSIONAL ENTRY-LEVEL COMPETENCIES

1. Program design, development, and evaluation.

The teacher will be able to:

1.10 utilize knowledges of physical, mental, social, and emotional growth and development which are defensible in terms of psychological and social learning theory, to plan learning experiences to meet the needs and goals of children.

1.20 plan the physical environment to insure student comfort, health, and safety and facilitate learning.

1.30 plan guidelines for developing and maintaining an educational environment conducive to the development of positive attitudes toward learning.

1.40 design alternative paths for students to satisfy program objectives.

1.50 cooperatively plan educational activities with colleagues, administrators, supervisors, personnel, students, and patrons of the school community.

1.60 plan for use of various evaluative procedures (feedback mechanisms) to be used as an integral part of the total learning concept.

2. Planning of instruction

The teacher will be able to:

2.10 plan motivational techniques that are appropriate for the developmental level of the pupils.

2.20 plan learning experiences which lead to an understanding of principles and generalizations which are transferrable from one context to another.

2.21 plan to encourage and utilize research and creative projects which are devised by students.

2.22 plan learning experiences with an appropriate mix and balance of learning objectives from the cognitive and affective taxonomies.

2.30 plan alternative ways for students to satisfy instructional objectives.

2.40 plan monitoring procedures which will provide for modifying classroom practices.

2.50 plan instruction in order that each student will develop a positive awareness of their individual differences.

3. Implementation of instruction

The teacher will be able to:

3.10 utilize in daily lessons motivational techniques that are appropriate for the level and needs of individual pupils.

3.20 provide daily learning experiences leading to an understanding of generalizations and principles which are transferrable from one context to another.

3.30 demonstrate the use of multi-level skillful questioning strategies which lead pupils to analyze, synthesize, and think critically.

3.40 provide alternative ways for students to satisfy instructional objectives commensurate with various levels of pupil ability.

3.50 use on-going verbal and non-verbal pupil feedback as input for possible instructional tactics.

3.60 demonstrate the ability to communicate subject matter, including the objectives, concepts, procedures, and words appropriate to the level of the pupils' understanding.

3.70 demonstrate the application of a spectrum of methods, organizational patterns, and materials consistent with instructional objectives.

3.80 use appropriate procedures as an integral part of daily instructional evaluations.

3.90 for each lesson, implement learning principles that are defensible in terms of psychological and social learning theories.

4. Management

The teacher will be able to:

4.10 adjust components of the physical, social and psychological environment to facilitate learning.

4.20 maintain control in the classroom, including the resolution of problems with a minimum of disruption.

4.30 manage and alter off-task pupil behavior.

5. Human Relations and Guidance

The teacher will be able to:

5.10 apply motivational techniques which maintain and increase pupil interests.

5.20 maintain an educational environment conducive to developing positive attitudes toward learning.

5.30 demonstrate a firm commitment to the ideal that teaching implies compassion and humility with a respect for the dignity of the student regardless of the value system of the teacher.

5.40 establish a teacher-pupil rapport which allows for constructive criticism and other feedback mechanisms.

5.50 discriminate between normal and deviant behavior and make referrals to appropriate professional agencies when necessary.

5.60 enhance self-development of pupils and create a positive awareness of individual differences.

6. School-Community Relations

The teacher will be able to:

6.10 correlate school and community activities.

6.20 demonstrate a willingness to relate his/her personal and professional values and employee obligations to the values of the community.

6.30 work cooperatively with all school personnel and patrons of the school community.

7. Personal and Professional Development

The teacher will be able to:

7.10 adapt to school situations and conditions.

7.20 continuously analize and develop his/her personal and professional values and employee obligations as they relate to the school community.

7.30 demonstrate an understanding of the limits of his/her professional competencies so that other appropriate professional assistance can be utilized, when necessary, to the benefit of the students.

Objective 3:

Each department will convert to performance-based education by translating existing courses into performance-based criteria. As courses are converted they will be implemented into the teaching schedule and field tested.

The translation of existing courses within each department to performance-based criteria was articulated by the material submitted under Objective 2. In order to implement these goals and in many cases specific sub-objectives, no major changes were made in the departmental course offerings. However, it is envisioned that future course offerings would take advantage of the goals established and group them into clusters. Once clusters of goals have been brought together, it is most probable that course offerings would be changed and thus the emphasis would be drawn away from course completion and move toward specific goal or competency attainment.

In the Automotive Technology Program this was partially accomplished through the implementation of the occupational sequences material in Auto Engines, Small Engines, and Automotive Suspension and Alignment.

Specifically, in these courses students progress on the basis of jobs completed by operations and thus proceed with a check-off of performances or competencies demonstrated.

Part II

The Performance-Based Education Project initiated a feed-back system using opinionnaires, to obtain information concerning students' perceptions of the performance goals and/or behavioral objectives established for particular courses.

Objective 4:

> Begin implementation of a feed-back system which is essential to the process of evaluating and refining the performance goals and delivery systems adapted.

This section presents responses from students relative to the aspects of Performance-Based Education implemented during the project year. First, information is presented concerning a course in Auto Engines (AT 121) offered by the Automotive Technology Department during the Fall of 1974. Secondly, information is presented regarding a course in Shop Maintenance. Following the information on Shop Maintenance is general information obtained on the performance-based component of the nursing program.

Student Responses to AT 121

Auto Engines 121 is a course offered by the Automotive Technology Department. During the 1973-1974 academic year, this course was translated into performance-based criteria through the specification of jobs and operations to be completed. Implementation of the course began during the Fall Quarter 1974.

The Performance-Based Education Project designed a student opinionnaire to obtain feed-back on those aspects of the course which were considered to be on a performance-based mode. (See Appendix C for the student opinionnaire)

The opinionnaire for AT 121 had seven major items related to performance or competency-based instruction. Twenty-five students were asked to anonymously complete the opinionnaire after checking off their performances and thus completing the requirements for the course. Respondents were asked to rate seven items on a five point scale; 5, strongly agree; 4, agree; 3, undecided; 2, disagree; 1, strongly disagree; and 0, no opinion. Each of the seven items was designed to obtain information concerning the performance-based aspects of the course. The summary data for the twenty-five respondents is presented in Appendix D.

In general, the respondents agreed or strongly agreed with the performance-based aspects of AT 121 as indexed by the opinionnaire. The overall mean of the means for all seven items was 3.97 or in the agree area of the response scale. The item receiving the highest mean rating was item four which questioned respondents about the related information included in the performance-based study guide. The mean for this item, 4.12 was above the agree category and approaching the strongly agree category. The item receiving the lowest mean response was item seven which questioned respondents about the clearness of requirements for a particular grade in the course (i.e., A, B, C, etc.) the mean for item seven was 3.84 or above the undecided category. Table II depicts the item number and mean response for the AT 121 opinionnaire.

TABLE II

SUMMARY OF MEANS BY ITEM FOR AT 121 STUDENT OPINIONNAIRE

(N = 25)

ITEM	MEAN	ITEM	MEAN
One	4.00	Five	4.08
Two	4.00	Six	3.84
Three	3.96	Seven	3.80
Four	4.12		

Student Response to the Course in Shop Maintenance

Shop Maintenance, a course offered by the Industrial Arts Department, was translated into performance goals and behavioral objectives during the early stages of the project. Implementation of the course on a performance basis was accomplished during the Fall Quarter 1974.

Response to the opinionnaire constructed for Shop Maintenance is presented in Appendix E. Nine students enrolled in the course responded to eight items using a five point Likert scale with the same categories as the AT 121 opinionnaire. The overall mean of the means was 3.56; above the undecided category and approaching the agree category. Item six, concerning the flexibility for students to work at their own pace, received the highest mean response, 4.11; while items one and four received the lowest mean response, 3.22. These low response items concerned the ability to obtain the goals and objectives established and the adequacy of material and equipment supplied. It should be noted that although the means for these two items were the lowest, they were still above the undecided category and approached the agree category. Table III summarizes the means, by item. for responses to the Shop Maintenance opinionnaire.

TABLE III

SUMMARY OF MEANS BY ITEM FOR SHOP MAINTENANCE OPINIONNAIRE

(N = 9)

ITEM	MEAN	ITEM	MEAN
One	3.22	Five	3.67
Two	3.56	Six	4.11
Three	3.44	Seven	3.78
Four	3.22	Eight	3.44

Student Response to LEGS Component of the Nursing Program

The Nursing Program at Northern Montana College has a multimedia, individualized, commercially produced component for performance-based education: LEGS (Learning Experience Guides). LEGS was published by John Wiley and Sons, New York, and meets the major criteria for performance-based programs, namely, individualization, self-pacing, specific goals and objectives and criterion referenced assessment procedures.

Twenty-nine students enrolled in the Nursing Program completed an opinionnaire designed to obtain feedback on the individualized, performance-based component of their program: LEGS. A summary of responses to each item on the LEGS opinionnaire is presented in Appendix F. The LEGS opinionnaire consisted of seven items with each item eliciting response on a five point scale similar to the scale used for AT 121. In general, responses to each item centered around the undecided category. The overall mean of the means was 3.27, slightly above the undecided category. The highest mean obtained was 3.90 for item five which stated: working on your own and in small groups allowed greater understanding of the concepts. The lowest mean response obtained, 2.55, was for item three which was stated: the material and equipment identified in the activities were easily located. Table IV shows a summary of means for each item on the LEGS opinionnaire.

TABLE IV

SUMMARY OF MEANS BY ITEM FOR LEGS OPINIONNAIRE

ITEM	MEAN	ITEM	MEAN
One	3.59	Five	3.90
Two	3.41	Six	3.21
Three	2.55	Seven	3.31
Four	2.90		

Survey of Vocational Education Graduates

In an attempt to provide input to the faculty from practioners in the field (education and industry), the Performance-Based Education Project staff designed a study to survey graduates, representative of all the programs offered by the Vocational-Technical Division concerning major tenents of performance-based education.

Method

In order to have a considerable number for inclusion in the survey, the Performance-Based Education Project staff obtained commencement lists for the years 1971 to 1974. All programs in the Vocational-Technical Division which granted degrees or certificates were identified from the four commencement lists. All graduates in each program for each of the four years were selected for inclusion in the study. The total number selected for inclusion in the study was 507. Table V depicts the total number of graduates selected by program area.

TABLE V

SAMPLE SELECTED FOR GRADUATE SURVEY BY PROGRAM AREA

PROGRAM	NUMBER SELECTED
Agricultural Technology	66
Automotive Technology	84
Cosmetology	27
Drafting	52
Engineering/Electrical Technology	55
Industrial Arts	70
Nursing	159
Total	507

Questionnaires were designed for each program area by the Performance-Based Education Project staff in consultation with the faculty of each department in the Vocational-Technical Division. In addition to major questions on

performance-based education, faculty members were encouraged to arrive at questions which would help in program modification or other departmental needs. (See Appendix A for example of survey instrument)

Results

Of the 507 questionnaires mailed to Vocational-Technical Division graduates, forty were returned by the postal service as "not deliverable" or "insufficient address." Of the 453 assumed delivered, the total number of questionnaires returned was 352 for an approximate 77 percent response. A breakdown of program areas with number and percentage of response is presented in Table VI.

TABLE VI

VOCATIONAL-TECHNICAL DIVISION GRADUATE SURVEY RESPONSES BY PROGRAM AREA

PROGRAM	TOTAL QUEST. MAILED	NO. RETURNED	% RESPONSE
Ag.-Tech	58	42	72%
Auto.-Tech	81	68	84%
Cosmetology	26	19	73%
Drafting	47	37	79%
Electronics	51	39	76%
Ind. Arts	67	51	76%

Respondents were asked to give their opinion on four major facets of performance-based education using a five point scale with (5) being most desirable to (1) least desirable. The information obtained from this section of the questionnaire is presented in the following tables.

The following abbreviations are used in Tables VII through X: Ag.-T, Agricultural Technology; A-T, Automotive Technology; C, Cosmetology; Dr., Drafting; El., Electronics; I.A., Industrial Arts; Nu., Nursing.

TABLE VII

ITEM: Do you think the program would be more desirable if it were to indicate to the student within the first week of the course precisely what is expected for exit or completion?

FREQUENCY OF RESPONSE BY PROGRAM AREA

Response Category	Ag.-T	A-T	C	Dr.	El.	I.A.	Nu.
5 Most Desirable	21	38	10	15	13	36	52
4 Desirable	9	9	3	7	5	5	4
3 Undecided	7	12	5	4	8	5	11
2 Undesirable	2	1	0	4	8	3	5
1 Least Desirable	2	8	1	4	2	1	16

TABLE VIII

ITEM: Do you think the program would be more desirable if it were individualized to provide for each student to progress through the course at his own pace?

FREQUENCY OF RESPONSE BY PROGRAM AREA

Response Category	Ag.-T	A-T	C	Dr.	El.	I.A.	Nu.
5 Most Desirable	7	18	1	7	6	9	9
4 Desirable	3	5	2	3	5	13	12
3 Undecided	7	18	3	5	10	10	23
2 Undesirable	11	10	4	2	8	8	10
1 Least Desirable	13	15	9	14	7	10	22

TABLE IX

ITEM: Do you think the program would be more desirable if it were to make provision for a student to graduate whenever he/she demonstrates satisfactory performance according to pre-established standards?

FREQUENCY OF RESPONSE BY PROGRAM AREA

Response Category		Ag.-T	A-T	C	Dr.	El.	I.A.	Nu.
5	Most Desirable	15	16	2	8	10	11	19
4	Desirable	9	9	1	2	6	10	16
3	Undecided	6	14	4	9	9	12	16
2	Undesirable	4	16	3	4	7	8	8
1	Least Desirable	6	13	9	10	4	9	25

TABLE X

ITEM: Do you think the program would be more desirable if it were to incorporate more alternative methods of instruction, such as, field trips, films, slide-tape material, programmed books, brief on-the-job learning experiences?

FREQUENCY OF RESPONSE BY PROGRAM AREA

Response Category		Ag.-T	A-T	C	Dr.	El.	I.A.	Nu.
5	Most Desirable	24	36	10	19	17	22	42
4	Desirable	7	13	2	8	11	14	11
3	Undecided	9	10	4	4	4	7	15
2	Undesirable	0	6	2	3	2	4	6
1	Least Desirable	1	3	1	0	1	3	11

Conclusions

After conducting the Performance-Based Education Project for one year, the following conclusions have been made by the project staff.

1. The concepts and philosophy of performance-based education have been well instilled in the minds of the professors. There will be a continuing application of the teaching practice using "performance-based" criteria. This was evident with the increased activity within the Vocational-Technical Division in the most recent months of the project.

2. In a developmental project such as this, the early months tend to be less productive than the latter months since a great deal of time and effort has to be devoted to familiarizing the faculty with the concepts and approaches to performance-based education.

3. Student satisfaction in a performance-based course may be greater the second or third time the course has been taught on the criteria referenced basis. This may indicate that the teacher feels more comfortable with the arrangement after it has been field tested.

4. Administrative encouragement plays a major role in the adoption process of innovative approaches to teaching.

5. When developing the program in performance-based education, considerable attention and interest was generated, therefore, it was necessary to provide a continuous approach to apprising the public of what was happening in performance-based education.

Implications

As the project developed some pressures and variables became evident. The following three implications suggest the overriding pressures.

1. As more and more courses are converted to performance-based criteria it becomes imperative that the entire program be converted to allow for the continous movement of the students through the program.

2. The performance-based education concept should be on a large scale pervading high schools and grade schools. Therefore, additional planning must be done to incorporate the technique in the high schools, thus eliminating the need for total readjustment as students enter postsecondary institutions using a performance-based approach.

3. The more involved a program becomes in performance-based criteria the more pressures are brought to bear to obtain equipment, supplies, and facilities which complement such a program.

Recommendations

Based on one year's experience with the project the following recommendations reflect the major desires of the performance-based education staff.

1. It is recommended that at least one person be assigned the responsibility of providing timely information to the faculty apprising them of the recent developments in performance-based education around the nation, such as identifying modules which have been developed or solutions which have been reported on problems related to implementing a true performance-based program, i.e., grading, adjusting from traditional quarter system or evaluation techniques.

2. It is recommended that studies be conducted to compare teacher effectiveness and student growth in courses adapted to performance-based criteria with those that use a traditional approach.

3. It is recommended that the college continue to develop administrative policy which will complement a true performance-based program, allowing for such concepts as open entry-exit, and criteria referenced exit rather than time referenced.

4. It is recommended that instruction be provided in the teacher training program, either at the graduate or undergraduate level, which will teach the concepts of the performance-based education movement, and encourage the implementation of it at the high school and elementary level. It has particular application potential in vocational education in the rural school.

A P P E N D I C E S

Name _____
Year of Graduation _____

APPENDIX A
GRADUATE SURVEY
VOCATIONAL-TECHNICAL DIVISION
NORTHERN MONTANA COLLEGE

Program: Automotive Technology

1. Please check your major area:

_____Automotive Service Technology

_____Automotive Technology (4 year)

_____Automotive Body Service Technology

_____Diesel Technology

2. Are your presently employed in a job for which you prepared at Northern Montana College?

_____yes _____no

Give your present job title and employer:

_____ _____

3. If you are not presently employed in an occupation for which you prepared, please indicate why by checking the appropriate reason. (In some cases more than one check will be needed.) Do not answer this question if you checked yes above.

_____A. No positions available for which I was prepared.

_____B. Jobs for which I prepared were available but my preparation was insufficient.

_____C. I originally took a job for which I prepared but I am presently working in another occupation.

_____D. Medical reasons.

_____E. Furthering my education.

_____F. Homemaking.

_____G. Military.

_____H. Other (specify) _____

_____

4. Please give your hourly, weekly, or monthly salary before any deductions. (optional)

_____Hourly _____Weekly _____Monthly OVER

5. The following courses are those currently offered in the Automotive Technology program. You may have taken all or some of them. Please rate from five (5) to one (1) those courses which you have taken on the basis of their contribution to your present position. A five (5) would indicate high contribution, while a one (1) would indicate low or little contribution. If you respond with zero (0) it would indicate the course had no contribution. Designate with an (X) those courses which you did not take or of which you can not recall the content.

EXAMPLES:

__5__ ET 216 Industrial Relations

In this example, the 5 would indicate that this particular course had a high contribution to the job or position you hold.

__X__ DR 116 Print Analysis and Interpretation

In this example, the X would indicate either you did not take the course or you do not recall the content.

_____DR 116 Print Analysis & Interpretation	_____ED 405 Current Issues in Ed.
_____ED 450 Secondary Tch. Pract.	_____ET 216 Industrial Relations
_____PY 100 General Psychology	_____PY 375 Drug & Alcohol Ed.
_____VT 300 Job Analysis	_____VT 320 Princ. of Voc. Ed.
_____VT 325 Meth. of Tch. Voc. Ed.	_____VT 424 Prep. of Inst. Mat.
_____VT 426 Vo-Tech Organ. & Mgt.	_____VT 430 Vocational Guidance
_____EG 151, 152, & 153 Comm. I, II, & III	_____ET 319 Coordinated Coop. Work Exp.

6. The following courses had laboratory periods as part of the instructional program. We would like you to not only rate the course as you have those above, but also indicate if the lab time was sufficient, insufficient, or too much.

EXAMPLE:

	Lab time was insufficient	sufficient	too much
3 AT 117 Auto. Power Trains		✓	

In this example the 3 would indicate that the course had average application to your present job and that you think that the lab time was sufficient for the course.

		Lab time was insufficient	sufficient	too much
____	AT 117 Auto. Power Trains			
____	AT 119 Auto. Braking Systems			
____	AT 120 Auto. Suspension & Align.			
____	AT 121 Auto Engines I			
____	AT 122 Auto Engines II			
____	AT 131 Paint & Body Estimating			
____	AT 132 Painting Techniques			
____	AT 134 Metal Finishing			
____	AT 200 Glass & Interior Trim			
____	AT 214 Chassis Sheet Metal Align.			
____	AT 234 Auto Electrical			
____	AT 236 Auto Fuel Systems			
____	AT 237 Auto Diag. & Tune Up			
____	AT 305 Auto Transmissions			
____	AT 307 Auto Service Practices			
____	AT 314 Hydraulics & Pneumatics			
____	AT 406 Auto Air Conditioning			
____	ED 325 Secondary Tch. Methd.			
____	IA 240 Electric Arc Welding			
____	IA 246 Oxy. Acet. Welding			
____	IA 285 Plastics			
____	PY 215 Psy. Found. of Ed.			
____	AT 225 Auto Machining			
____	DI 114 Intro. to Engines			
____	DI 115 Diesel Eng. Main. & Rep.			
____	DI 217 Fuels & Fuel Systems			
____	DI 218 Diesel Shop Practice			

7. We would like your opinion concerning changes in the curriculum in which you majored. In some cases we have asked direct questions, however, please add your thoughts on the blank lines provided.

   A. Should oxy-acetylene welding be required in the automotive program?

   _____yes _____no _____no opinion

   B. Should arc welding be required in the automotive service program?

   _____yes _____no _____no opinion

   C. Is there a need for a course on foreign car servicing?

   _____yes _____no _____no opinion

   D. Should a course in basic electricity be a prerequisite to the automotive electrical course?

   _____yes _____no _____no opinion

OVER

E. Should a course in servicing motorcycles, snowmobiles, and other recreational vehicles be offered?

_____yes _____no _____no opinion

F. Should a course in mathematics related to the automotive program be required in the program?

_____yes _____no _____no opinion

G. _____

_____

_____

8. We would like your opinion on the following statements. Please rate them one (1) to five (5). (5): most desirable; (1): least desirable.

Do you think the program would be more desirable if it were:

_____A. to indicate to the student within the first week of the course precisely what is expected for exit or completion?

_____B. individualized to provide for each student to progress through the course at his own pace?

_____C. to make provision for a student to graduate whenever he/she demonstrates satisfactory performance according to pre-established standards?

_____D. to incorporate more alternative methods of instruction, such as, field trips, films, slide-tape material, programmed books, brief on-the-job learning experiences?

9. Please feel free to add any additional comments.

_____

_____

_____

_____

_____

_____

NORTHERN MONTANA COLLEGE
MONTANA UNIVERSITY SYSTEM
HAVRE 59501

VOCATIONAL-TECHNICAL DIVISION

APPENDIX B

January 16, 1975

Dear NMC Alumnus:

A few weeks ago you received a questionnaire on which we wanted you to respond to a few questions relative to the program you pursued at Northern Montana College. According to our records you have not responded to the request to date.

Although we have received many responses, it is important that we have input from all graduates. Therefore, we would appreciate it if you would take a few minutes to complete the form and return it as soon as possible.

We have enclosed another questionnaire in case you have misplaced the original one.

Thank you for your response.

Sincerely yours,

Albert VanderLinde

Dr. Albert VanderLinde, Dean
Vocational-Technical Division

A W Korb

Dr. A. W. Korb, Director
Performance-Based Education Project

AV/AWK:sl

Enclosures

PBE 6/74
CS Form
AT 121

APPENDIX C

PBE OPINIONNAIRE

The Performance-Based Education staff would like your opinion concerning the Blue Study Guide used as supplementary material for AT 121.

The following statements represent opinions. Please check your position on the scale as the statement first impresses you. The scale is as follows:

5 strongly agree, (SA);

4 agree, (A);

3 undecided, (UD);

2 disagree, (D);

1 strongly disagree, (SD);

0 no opinion

1. The operations listed in the Study Guide clearly stated what you were expected to do.

5	4	3	2	1	0
SA	A	UD	D	SD	

2. The steps listed in the operation breakdown assisted you in successfully completing the operation.

5	4	3	2	1	0
SA	A	UD	D	SD	

3. The required tools and equipment necessary to complete the operation were included in the Study Guide.

5	4	3	2	1	0
SA	A	UD	D	SD	

4. The items of related information proved valuable to the completion of the operation.

5	4	3	2	1	0
SA	A	UD	D	SD	

5. The Study Guide allowed you to work individually with a greater understanding of engine overhaul practices.

5	4	3	2	1	0
SA	A	UD	D	SD	

6. The supplementary information as presented in the Study Guide allowed more flexibility in terms of time, lab work and student/instructor relationships.

5	4	3	2	1	0
SA	A	UD	D	SD	

7. The requirements necessary to obtain a particular grade (A, B, C, etc.) were clearly stated at the beginning of the course.

5	4	3	2	1	0
SA	A	UD	D	SD	

8. Please list the strong points of the Study Guide.

9. Please list the major drawbacks of the Study Guide.

10. Please list any suggestions you may have to improve the Study Guide.

APPENDIX D

SUMMARY OF RESPONSES FOR ITEMS ON THE STUDENT OPINIONNAIRE FOR AT 121 AUTO ENGINES

(N = 25)

Item one: The operations listed in the Study Guide clearly stated what you were expected to do.

The mean rating for all responses on item one was 4.0. Percentages of responses for scaled categories on item one were as follows:

strongly agree	16%
agree	68%
undecided	16%
disagree	0%
strongly disagree	0%
no opinion	0%

Item two: The steps listed in the operation breakdown assisted you in successfully completing the operation.

The mean rating for all responses on item two was 4.0. Percentages of responses for scaled categories on item two were as follows:

strongly agree	20%
agree	64%
undecided	12%
disagree	4%
strongly disagree	0%
no opinion	0%

Item three: The required tools and equipment necessary to complete the operation were included in the Study Guide.

The mean rating for all responses on item three was 3.96. Percentages of responses for scaled categories on item three were as follows:

strongly agree	28%
agree	64%
undecided	0%
disagree	0%
strongly disagree	0%
no opinion	8%

Item four: The items of related information proved valuable to the completion of the operation.

The mean rating for all responses on item four was 4.12. Percentages of responses for scaled categories on item four were as follows:

strongly agree	28%
agree	60%
undecided	8%
disagree	4%
strongly disagree	0%
no opinion	0%

Item five: The Study Guide allowed you to work individually with a greater understanding of engine overhaul practices.

The mean rating for all responses on item five was 4.08. Percentages of responses for scaled categories on item five were as follows:

strongly agree	24%
agree	64%
undecided	8%
disagree	4%
strongly disagree	0%
no opinion	0%

Item six: The supplementary information as presented in the Study Guide allowed more flexibility in terms of time, lab work and student/instructor relationships.

The mean rating for all responses on item six was 3.84. Percentages of responses for scaled categories on item six were as follows:

strongly agree	16%
agree	52%
undecided	32%
disagree	0%
strongly disagree	0%
no opinion	0%

Item seven: The requirements necessary to obtain a particular grade (A, B, C, etc.) were clearly stated at the beginning of the course.

The mean rating for all responses on item seven was 3.80. Percentages of responses for scaled categories on item seven were as follows:

strongly agree	20%
agree	52%
undecided	20%
disagree	4%
strongly disagree	4%
no opinion	0%

APPENDIX E

SUMMARY OF RESPONSES FOR ITEMS ON THE STUDENT OPINIONNAIRE FOR SHOP MAINTENANCE

(N = 9)

Item one: The overall performance goals established were attainable through the behavioral objectives.

The mean rating for all responses on item one was 3.22. Percentages of responses for scaled categories on item one were as follows:

strongly agree	0%
agree	67%
undecided	11%
disagree	11%
strongly disagree	0%
no opinion	11%

Item two: The behavioral objectives clearly stated what you were expected to do.

The mean rating for all responses on item two was 3.56. Percentages of responses for scaled categories on item two were as follows:

strongly agree	22%
agree	44%
undecided	11%
disagree	11%
strongly disagree	11%
no opinion	0%

Item three: The activities listed assisted you in achieving the behavioral objectives.

The mean rating for all responses on item three was 3.44. Percentages of responses for scaled categories on item three were as follows:

strongly agree	11%
agree	56%
undecided	11%
disagree	11%
strongly disagree	11%
no opinion	0%

Item four: The materials and equipment identified in the activities were easily located.

The mean rating for all responses on item four was 3.22. Percentages of responses for scaled categories on item four were as follows:

strongly agree	0%
agree	56%
undecided	22%
disagree	11%
strongly disagree	11%
no opinion	0%

Item five: All of the activities listed were necessary to enable you to fulfill the behavioral objectives.

The mean rating for all responses on item five was 3.67. Percentages of responses for scaled categories on item five were as follows:

strongly agree	22%
agree	33%
undecided	33%
disagree	11%
strongly disagree	0%
no opinion	0%

Item six: Working at your own pace allowed greater understanding of the concepts.

The mean rating for all responses on item six was 4.11. Percentages of responses for scaled categories on item six were as follows:

strongly agree	22%
agree	67%
undecided	11%
disagree	0%
strongly disagree	0%
no opinion	0%

Item seven: Performance-based education allowed more flexibility in terms of time, lab work and student/instructor relationships.

The mean rating for all responses on item seven was 3.78. Percentages of responses for scaled categories on item seven were as follows:

strongly agree	22%
agree	44%
undecided	22%
disagree	11%
strongly disagree	0%
no opinion	0%

Item eight: The means of evaluation used by the professor were directly related to the behavioral objectives.

The mean rating for all responses on item eight was 3.44. Percentages of responses for scaled categories on item eight were as follows:

strongly agree	11%
agree	44%
undecided	33%
disagree	0%
strongly disagree	11%
no opinion	0%

APPENDIX F

SUMMARY OF RESPONSES FOR ITEMS ON THE STUDENT OPINIONNAIRE FOR THE NURSING PROGRAM

(N = 29)

Item one: The behavioral objectives in the LEGS program clearly stated what you were expected to do.

The mean rating for all responses on item one was 3.59. Percentages of responses for scaled categories on item one were as follows:

strongly agree	7%
agree	62%
undecided	14%
disagree	17%
strongly disagree	0%
no opinion	0%

Item two: The activities listed assisted you in achieving the behavioral objectives.

The mean rating for all responses on item two was 3.41. Percentages of responses for scaled categories on item two were as follows:

strongly agree	3%
agree	69%
undecided	7%
disagree	10%
strongly disagree	7%
no opinion	3%

Item three: The materials and equipment identified in the activities were easily located.

The mean rating for all responses on item three was 2.55. Percentages of responses for scaled categories on item three were as follows:

strongly agree	0%
agree	28%
undecided	17%
disagree	38%
strongly disagree	17%
no opinion	0%

Item four: All of the activities listed were necessary to enable you to fulfill the behavioral objectives.

The mean rating for all responses on item four was 2.90. Percentages of responses for scaled categories on item four were as follows:

strongly agree	0%
agree	38%
undecided	17%
disagree	41%
strongly disagree	3%
no opinion	0%

Item five: Working on your own and in small groups allowed greater understanding of the concepts.

The mean rating for all responses on item five was 3.90. Percentages of responses for scaled categories on item five were as follows:

strongly agree	28%
agree	52%
undecided	10%
disagree	3%
strongly disagree	7%
no opinion	0%

Item six: Individualized instruction as presented in the LEGS program allowed more flexibility in terms of time, lab work and student/ instructor relationships.

The mean rating for all responses on item six was 3.21. Percentages of responses for scaled categories on item six were as follows:

strongly agree	17%
agree	41%
undecided	3%
disagree	21%
strongly disagree	17%
no opinion	0%

Item seven: The means of evaluation used by the instructors were directly related to the behavioral objectives.

The mean rating for all responses on item seven was 3.31. Percentages of responses for scaled categories on item seven were as follows:

strongly agree	3%
agree	52%
undecided	28%
disagree	7%
strongly disagree	10%
no opinion	0%

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